TB MED 184

WAR DEPARTMENT TECHNICAL BULLETIN

DISINFESTATION PROCEDURES

War Department, Washington 25, D. C. • • • July 1945

This bulletin follows TB MED 183, subject, "Visceral Leishmaniasis—Kala-Azar." Distribution given TB MED 183 was identical to that given TB MED 142.

INTRODUCTION: Disinfestation is a general term applied to the extermination of insects, vermin, and other parasites present upon or within the person, clothing, or immediate environment of an individual or group of individuals. In this bulletin disinfestation procedures are described for the disease-bearing insects most commonly encountered, namely, lice, fleas, ticks, and mites. (For mosquitoes and biting flies, see TB MED 134 and TB MED 82.) These suggested procedures are for general guidance and are to be modified as local conditions require.

2. LICE. Disinfestation in the case of lice is commonly known as delousing. Since lice or their eggs are often on both the person and clothing of an infested individual, effective delousing provides for the disinfestation of both the person and his clothing at the same time. For this reason the procedures described for delousing of personnel are to be followed in conjunction with the delousing of clothing, bedding, and equipment. Head lice and pubic lice may be grouped with body lice for disinfestation. At marine ports of embarkation in continental United States facilities are available for the fumigation or steam sterilization of clothing, bedding, and equipment, and for bathing and application of louse spray to the person of infested individuals. At oversea ports of embarkation and all other locations where disinfestation is required and suitable fumigation and sterilization equipment is not available, delousing may be accomplished by dusting with louse powder. Due to its adaptability for field use, dusting will ordinarily be the method of choice for delousing in oversea theaters.

a. Delousing of personnel. (1) *Dusting.* If the dusting method is used, only hatched lice are killed, and it will be necessary to reapply louse powder after eggs have hatched. This method of delousing is particularly applicable to civilian population and to prisoner of war enclosures, oversea staging areas, and ports of embarkation for returning troops. Since a period of time subsequent to dusting is required for the elimination of infestation, delousing by dusting will not be used in United States ports of debarkation for infested returned troops, except as a supplement to other measures.

(*a*) *Equipment and supplies.* Dusting may be accomplished by the use of hand dusters (duster, powder, insecticide QM stock No. 41–D–3755), or by power dusters (outfit, delousing, gasoline-engine-driven, QM stock No. 66–O–800). The power dusting outfit furnishes compressed air for 10 dust guns, included with the outfit, with which an operating team can dust a total of 600 individuals and their unremoved clothing per hour. The dusting powder used for delousing is insecticide, powder, louse, QM stock No. 51–I–180. About 100 pounds will be required for each thousand men to be deloused.

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Additional powder would be required for extra clothing and bedding.

(*b*) *Application.* When dusting is adopted as the routine method for delousing personnel, both the person and his unremoved clothing are treated in one operation. The procedure for this is as follows:

1. The man is directed to loosen his collar and tie, his belt, and then to stand (or to sit) with hat in hand.

2. Dust the head until whited, separating the hair to insure even distribution, and also dust the hat.

3. Insert nozzle of dust gun in the right sleeve next to the skin with the man's arm held out at shoulder height and direct powder toward the armpit. With power duster, hold trigger down until dust emerges from the loosened neck of the shirt. With hand duster, two or three full strokes are required. The face is turned away from the dust. Repeat for the left sleeve, next (or after step 4).

4. Insert nozzle in the front of the shirt at the collar and direct powder toward the right armpit, toward the belly, and toward the left armpit. The operator stands in front of the man, who leans forward with head tipped back for this step.

5. Insert nozzle in back of shirt at collar and direct powder toward the right shoulder, the middle of the back, and the left shoulder. For this step the head is bent forward onto the chest. Additional powder is deposited on the collar itself, where lice frequently abound.

6. Insert nozzle in front of trousers at the waistband, next to the skin, with the man standing, and direct powder toward the right leg, the crotch, and the left leg.

7. Insert nozzle in back of trousers, next to the skin, and direct powder toward the right leg, the buttocks crease, and the left leg.

(*c*) With hand dusters, two full even strokes in each position (each dose) are required. With power dusters, a momentary pressure on the trigger to release a like amount of powder is all that is necessary; the exact timing is learned by experience. Individuals learning the dusting technique should remove the clothing of the first few persons after dusting to note whether the powder is completely and evenly distributed and whether the proper amount has been applied. Only a perceptible dustiness is required; an excess which may cause individuals to remove the powder immediately by bathing or changing clothes should be avoided.

(2) *Spraying.* The proper use of spray will kill most eggs as well as adult lice. Some eggs may escape death if they are near hatching and protected by an air space within their shell. This method of delousing personnel will ordinarily be utilized only where facilities for fumigation or steam sterilization are present, as in certain U. S. ports, and when the immediate destruction of all lice is desired.

(*a*) *Equipment and supplies.* Spraying is accomplished by the use of ordinary hand sprayers, such as sprayer, liquid, insecticide, continuous spray, 2-qt, QM stock No. 41–S–4105, or other suitable sprayers for atomizing liquids. The louse spray, to be used only on the human body, is insecticide, spray, delousing, QM stock No. 51–I–310. About 5 gallons will be required for each thousand men to be deloused.

(*b*) *Application.* Preliminary to the spraying, a cleansing bath is taken. With any mild soap, the head is thoroughly shampooed, and the rest of the body adequately cleansed. A clean towel should be provided for drying. Spray is applied to all hairy parts of the body. The eyes are closed and covered with the horizontally placed index fingers when the eyebrows are sprayed. Head hair is given effective coverage by spraying from all sides as well as the top. Chest hair is sprayed, as well as the hair of the axillary, pubic, and anal areas. The arm and leg hair of excessively hairy persons is also sprayed. Unnecessary wetting of the skin with spray is avoided. A slow manipulation of the sprayer plunger allows the mist to settle into the hair instead of diffusing into the air. If allowed to dry on the body, the spray destroys all lice and eggs and is effective for several days in preventing reinfestation.

b. Delousing of clothing, bedding, and equipment. (1) *Dusting.* The unremoved clothing of individuals is dusted with louse powder at the same time disinfestation of the person is accomplished, as described in *a* (1) (*b*) above. Other clothing, bedding, and equipment may also be disinfested by dusting. Louse powder may be applied by hand dusters or by power dusters. All surfaces, particularly the seams

and inner folds of clothing and bedding, are to be treated. Shaking or beating of bagged or stacked textiles will assist even distribution of the powder. For complete disinfestation by this method, time must be allowed for the lice to crawl about and expose themselves to the powder. A minimum of 24 hours after exposure is required to insure death of lice. Eggs are not destroyed by this method, and the louse powder must remain in the clothing, bedding, and equipment for about 10 days, or until all eggs have hatched, so as to kill the newly hatched nymphs.

(2) *Fumigation with methyl bromide.* (*a*) *General.* Methyl bromide is a colorless, odorless, volatile liquid, boiling at 40° F. to produce a gas which is highly effective in destroying all forms of insect life. This gas is three and one-half times as heavy as air, but diffuses readily, and, when thoroughly mixed with air, does not settle rapidly. It has unusual properties of penetration and is effective at much lower temperatures than most fumigants. Its effectiveness is not decreased by the presence of moisture, unless sufficient water is present to form a film which prevents penetration. In its gaseous state the use of methyl bromide is usually limited to fumigation within tight enclosures. When properly employed it kills lice and their eggs after relatively short exposure periods. Exposure to methyl bromide makes lice more active and they may be seen wandering about the clothing immediately after fumigation. However, these lice are unable to feed or lay viable eggs and they will soon die. Methyl bromide does not injure or shrink fabrics or leather, is not corrosive to metals, and will not damage other items such as musical instruments, watches, and cameras. However, it has occasionally been reported to cause offensive odors from sponge rubber. No sorting of clothing or equipment, with separate treatment of each type, is required when deloused by this method.

(*b*) *Precautions.* High concentrations of methyl bromide are dangerous to man. Exposure to low concentrations for short periods of time will not cause serious disturbance, but should not be continued beyond certain limits. Harmful concentrations of methyl bromide may be determined with the halide leak detector (Frigidaire Leak Detector, Piece SA–2136, or equal) by noting the color changes in an alcohol flame. This leak detector consists of an alcohol torch which heats a copper coil and a sampler tube which picks up air and supplies it to the flame. The tube must be kept clean, since particles of lint or dust will interfere with the test. The torch is adjusted to give a strong colorless flame which brings the copper coil to a red heat. In the present of methyl bromide (or other halide) the flame becomes green or blue as indicated in the following table:

Flame color	Parts methyl bromide (per million by volume)	Pounds methyl bromide (per thousand cubic feet)
Almost invisible	0	0
Rather faint green	40	0. 010
Moderate green	60–100	. 014– . 024
Strong green; slightly blue at edges	130	. 031
Strong green; rather blue	180	. 043
Strong blue-green	240–360	. 058– . 086
Strong blue	800	. 192

Warm blooded animals can survive high concentrations for brief periods, but prolonged exposures to low concentrations may be injurious or even lethal. Based on observations of its effect on animals, it is believed that accidental exposure to the concentrations of methyl bromide ordinarily used in fumigation is not likely to cause injury. However, working many hours in a relatively low concentration may be harmful. The maximum concentration allowable within fumigation plants should not exceed 30 parts per million. The air about the fumigation vaults and in the areas where fumigated clothing is handled should be tested frequently to assure safety. If directions are carefully followed, the entire procedure of fumigation for delousing clothing can be done safely without the wearing of gas masks by operating personnel.

(*c*) *Methods. 1. Vault fumigation.* (a) *Equipment and supplies.* The vault provided for the fumigation of clothing and other equipment consists of a gas-tight chamber with means for introducing and circulating methyl bromide. The amount of methyl bromide used will depend on the temperature of the clothing or other material which is fumigated. When temperature is 60° F. or over, the dose is 3 pounds per standard vault (about 330 cubic feet), or at the rate of 9 pounds per thousand cubic

feet. For all temperatures below 60° F. use 4 pounds methyl bromide in the standard vault, or at the rate of 12 pounds per thousand cubic feet. The duration of exposure to the full concentration of the gas is 30 minutes, regardless of temperature. Methyl bromide in 1-pound cans is requisitioned from the quartermaster as stock No. 51–M–892.

(b) *Procedure.* The men to be deloused bring with them for disinfestation all items of individual clothing and equipment, including barrack bags, and proceed as in steps 1, 2, and 9, below, while fumigation personnel ordinarily carry out steps 3 to 8 inclusive:

(*1*) Each man undresses, places all clothing and equipment, including that worn, in the barrack bag, closes it, and marks it for identification. Everything, including shoes, helmet, and valuables, must be disinfested.

(*2*) After depositing the closed barrack bags at a designated point, the men proceed with personal disinfestation as described in *a* (2) (*b*) above.

(*3*) Load the fumigation vault with bags on tiers of removable shelving. If trucks are provided, load bags onto the trucks and then wheel into the vault.

(*4*) Close tightly the vault door and all openings, and set the damper to "circulate."

(*5*) Start the circulating fan or blower and introduce the required amount of methyl bromide (see above). Immediately upon introducing the methyl bromide, make a careful search for leakage with the halide detector; or, if the vault is equipped with a pressure gauge, watch this closely for signs of leakage. Locate leaks, if present, and stop with caulking compound.

(*6*) Start the timer and circulate the methyl bromide for 30 minutes.

(*7*) Set the damper to EXHAUST, and ventilate for 10 minutes. During the last 5 minutes of this period, open the door to allow better ventilation. Do not enter the vault until the end of this ventilating period.

(*8*) Remove bags from the vault and transport to the dressing station or entrance to the "shake-out" room, identify, and return to owners.

(*9*) The men shake out each garment thoroughly and dress in a well ventilated area. Make occasional tests with the halide detector to assure less than 30 parts per million methyl bromide in the dressing area.

2. Bag fumigation. This method is used only out-of-doors or under shelters with no side walls. Since it is not convenient to vary the amount of methyl bromide used, it is necessary to vary the time for exposure according to temperature, as indicated in the following table:

Temperature degrees Fahrenheit	Length of exposure to 1 ampule methyl bromide
60 or over	¾ hour.
50 to 59	1¼ hours.
40 to 49	1¾ hours.
−9 to 39	2¼ hours.

(a) *Equipment and supplies.* Bag fumigation is done in the bags, delousing, QM stock No. 27–B–208. There is an inner pocket for an ampule of methyl bromide, which is broken after the bag is closed. The walls of the bag are of impervious material, and the ends are folded and tied for closing. The fumigant for use in bags is methyl bromide, 20 cc ampules, QM stock No. 51–M–888.

(b) *Procedure.* A numbered bag and identifying tag is issued to each man who places therein all his clothing and equipment. The operator inserts an ampule of methyl bromide, closes the bag, lays the bag on its side, and releases the gas within the bag by breaking the ampule. During the period of exposure (see above table for time required) the men proceed with personal disinfestation as described in *a* (2) (*b*) above. At the end of the exposure period, the bags are identified, opened, and emptied, care being taken to avoid breathing the gas. After airing for 5 minutes, the clothing may be worn, each garment being first shaken thoroughly.

3. Pit fumigation. When vaults or delousing bags are not available, it may be necessary to use a pit. By digging a hole 5 feet deep and 5 feet in diameter, space is made for about 20 barrack bags. The hole is covered with tar paper, rubberized raincoats, or other impervious covering, the edges of which are sealed by covering with earth. About 1 pound of methyl bromide is required to fumigate each 12 to 20 bags. Care must be used in releasing the methyl bromide, so that none of the liquid will

spill on the hands. If chilled with an ice-salt mixture for half an hour, the can may be pierced with an ordinary nail in relative safety. The opened can is immediately dropped on top of the bags, and the pit sealed. After the required time of fumigation (same as in *2* above), the bags are removed on the windward side with a hooked pole or other suitable means. The clothes are shaken out on the ground to air.

(3) *Steam sterilization.* Disinfestation of clothing, bedding, and infested equipment by steam will kill lice, their eggs, and the ricketsia which cause typhus fever. However, due to the injurious effects of steam on woolens and leather, this method has been largely replaced by other procedures. If a hospital should have occasion to admit a typhus fever patient, the clothing may be boiled for several minutes or soaked in cresol solution before laundering by standard quartermaster formulas. If facilities for steam sterilization are available, materials which are not injured by steam may be both disinfested and disinfected by autoclaving at 15 pounds pressure for at least 15 minutes. Since steam sterilization or boiling is applicable to certain types of material only, supplemental methods of disinfestation will be required.

(4) *Storage.* Storage of infested clothing and equipment will accomplish disinfestation by depriving the lice of a food supply. The exact time required is dependent on the temperature. A safe rule is to keep articles in storage at least 30 days. If the temperature is continuously (day and night) above 70° F., 21 days is sufficient. In this time the eggs will have hatched, and the newly hatched nymphs and the adults will have died. This method is practical for disinfesting clothing and blankets in hospitals and camps, providing storage facilities are available. Rodents and all other forms of animal life upon which lice may feed must be excluded. Fresh material which may be infested should not be placed with that which has been in storage for some time. No articles should be removed from a room until all articles have been in storage the full period of either 21 or 30 days.

(5) *Other methods.* Exposure of infested clothing, bedding, or equipment to a temperature of −10° F. or colder for at least 2 hours will destroy lice and their eggs. The interior of folded or packed materials must be allowed to reach the required temperature before measuring the 2-hour period. Laundering of clothing by the quartermaster laundry formulas, or dry cleaning, will disinfect clothing, but provision should be made to prevent infestation of the laundry or cleaning establishment and its operators and the reinfestation of clothing subsequent to laundering or cleaning. Heat, as in pressing, in the absence of more desirable methods, may be used to destroy lice and eggs in the seams of garments.

3. FLEAS. *a. General.* The presence of fleas at any time will require that procedures for their extermination be instituted. Where human fleas, such as *Pulex irritans*, are present, measures must be directed toward the use of repellents and insecticides by individuals, besides the institution of general control procedures. Thorough housecleaning should be directed toward the removal of breeding material—such as dust and the fecal material of insects and rodents—from floor cracks, corners, from under floor coverings, and from within packing boxes, and toward the dusting of these places with insecticide, powder, louse. Such warm blooded animals as rodents (including bats) and, as far as practical, birds which have access to buildings occupied by troops should be destroyed or excluded, as indicated. All pets and nonmilitary domestic animals should be treated with insecticide or excluded from troop quarters. Insecticide, powder, louse, in a strength of 5 percent DDT (half strength), should be applied to infested military animals, repeating the treatment at such intervals as existing conditions may necessitate. Kennels and animal quarters may be dusted with half-strength insecticide, powder, louse or sprayed with residual spray, caution being taken to not allow animals to come in contact with sprayed areas until after they have been well ventilated and well dried. When packing organizational equipment for movement, all shipping containers should be cleaned, insecticide, spray, residual effect or insecticide, powder, louse, should be applied to the interior of boxes, and textiles should be dusted with louse powder.

b. Conveyances. The interior of trucks, planes, boats, or other conveyances should be inspected prior to loading for movement and,

if found infested with fleas, should be thoroughly cleaned of dust, and disinfested by the application of insecticide, spray, residual effect, or insecticide, powder, louse, or by fumigation.

c. Preventive measures. Insect repellent may be applied as a spray to the clothing of personnel, or to the fur and legs of animals, as a temporary protection from flea bites, if it is necessary to pass through infested areas.

4. TICKS. *a. Personnel.* When operating in an area which is infested with ticks, frequent physical inspections should be made to determine the presence of attached ticks. At such special physical inspections all ticks should be removed, and, if there is a possibility of infection with relapsing fever, Rocky Mountain spotted fever, or tularemia, the individual from whom the tick has been removed may remain with his unit, but should be instructed to report to the medical officer, if symptoms develop.

b. Animals. In areas where ticks are prevalent, all animals or pets should be routinely inspected and freed of any tick infestation. When embarking animals from an area where tick infestation is present, care should be taken to see that animals are free from ticks. The advice of the veterinary officer will be sought.

5. MITES. (See TB MED 31.) *a. Personnel.* A cleansing bath, together with the laundering of clothing which may have been worn in mite-infested areas, will ordinarily be sufficient disinfestation for mites. If laundering is inadvisable, disinfestation of clothing may be effected by spraying with repellent, insect, clothing treatment, QM stock No. 51–R–300. The prophylactic use of impregnated clothing is advised where infestation can be anticipated (TB MED 121). Footgear should be well cleaned of adherent mud.

b. Organizational textile equipment. Organizational textile equipment such as tentage may be sprayed with insect repellent or dusted with insecticide, powder, louse, at the time it is rolled or packed for movement, if it has been exposed to infested vegetation.

c. Packing materials. No grass or other vegetation that may be infested with mites should be used as packing material.

d. Miscellaneous. The treads, wheels, mudguards, and any other parts of vehicles or other equipment to which mud may cling, should be well cleaned of adherent soil.

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BY ORDER OF THE SECRETARY OF WAR:

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